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A47 Wansford to Sutton Dualling

Scheme Number: TR010039

Volume 9
9.33 Underpass Lighting Assessment Technical Note

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Rule 8(1)(c)

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The Infrastructure Planning (Examination Procedure) Rules 2010

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9.33 UNDERPASS LIGHTING ASSESSMENT TECHNICAL NOTE

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Technical Note

The purpose of this technical note is to explain why lighting is not proposed within the following underpasses:

- The Walking, cycling and horse riding route on the disused railway track (S02)
- Sacrewell Farm underpass (S05)

Underpass S02 serves the walking / cycling and horse-riding route on the disused railway track. The levels of path use are likely to be low during late evenings and early mornings.

The premises that the underpass S05 will serve (Sacrewell Farm) closes to the public at 4:30pm. Therefore, in winter months, during the hours of darkness, the volume of traffic accessing and egressing from the visitor centre is not likely to be significant in volume. Following the closure of the farm to visitors at 4:30pm and the final departure of customers / visitors, lighting would provide unnecessary illumination of the underpass.

The existing sites are currently unlit and therefore the ecological sensitivity is an important consideration in the implementation of lighting. It could not be demonstrated that the addition of lighting for underpass would not adversely impact ecology receptors because the increase in lighting levels on the existing baseline would be significant. Nocturnal species, such as bats and badgers can be adversely affected by lighting and will often avoid illuminated areas. Both underpasses will also serve an ecological function by increasing connectivity between habitats to the north and south of the proposed scheme, and as such the introduction of lighting in these underpasses would limit their function as a wildlife corridor.

A Safety Risk assessment (Appendix A) identified hazards associated with the underpass being unlit and did not highlight any medium or high level risks for individual users. A risk value of 9, which is still considered to be “broadly acceptable”[1], was identified for the risk of criminality involving assault or robbery, this was on the basis that low levels of illumination within the structure may conceal a person intent on criminal activity.

However, research shows there are limited direct correlations between the presence of lighting and increased safety. In fact, where lighting is not designed and installed correctly, there is the potential for lighting to present detrimental effects on safety, as it can highlight a victim, whilst disabling the victim’s view of their attacker.

The International Dark – Sky Association states:

[1] In the terms of the Health and Safety Executives Tolerance of Risk Model.

"A 2015 study published in the Journal of Epidemiology and Community Health[2] found that streetlights don't prevent accidents or crime, but do cost a lot of money. The researchers looked at data on road traffic collisions and crime in 62 local authorities in England and Wales and found that lighting had no effect, whether authorities had turned them off completely, dimmed them, turned them off at certain hours, or substituted low-power LED lamps.

According to the study, "When risks are carefully considered, local authorities can safely reduce street lighting saving both costs and energy … without necessarily impacting negatively upon road traffic collisions and crime."

According to a 2011 study of London street lighting and crime[3], there is no good evidence that increased lighting reduces total crime." A 1997 National Institute of Justice study concluded, "We can have very little confidence that improved lighting prevents crime."

Lighting of the underpasses would also require additional lighting of the approaches to ensure safe levels of light for pedestrians exiting the underpasses into an urban unlit setting. This also has the potential to adversely affect ecology due to the lighting levels that would be necessary. If lighting was provided only to the underpass, it is considered that this has high potential to reduce safety for pedestrians and is unlikely to have a direct correlation between the reduction or prevention of crime based on academic research.

In summary, lighting is not proposed within the underpasses. A risk assessment undertaken did not identify any medium or high risks associated with this. Research has also shown that the provision of lighting in underpasses does not necessarily make them any safer. The effects of lighting on ecology receptors would also be significant.

[2] Steinbach R, Perkins C, Tompson L, et al. The effect of reduced street lighting on road casualties and crime in England and Wales: controlled interrupted time series analysisJ Epidemiol Community Health 2015;69:1118-1124

Copy of study provided in Appendix B

[3] Lawrence W. Sherman, Denise Gottfredson, Doris mackenzie, John Eck, Peter Reuter, and Shawn Bushway. PREVENTING CRIME: WHAT WORKS, WHAT DOESN'T, WHAT'S PROMISING, Department of Criminology and Criminal Justice University of Maryland.

Extract of study provided in Appendix C

Appendix A. GG104 Safety Risk Assessment

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Figures

Tables

1. Scheme introduction

1.1. Scheme Background

1.1.1. The A47 forms part of the Strategic Road Network (SRN) and provides for a variety of local, medium and long-distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich and Peterborough, the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft and a succession of villages in what is largely a rural area. A47 Wansford to Sutton is 1 of the 5 schemes considered in the Road Investment Strategy (RIS).

1.1.2. The A47 Wansford to Sutton dualling scheme is approximately 2.5 kilometres in length located in the county of Cambridgeshire between the A1 / A47 junction and the A47 Nene Way Roundabout in Sutton, west of Peterborough.

1.1.3. The existing A47 single-carriageway is to be upgraded to dual-carriageway standard (D2AP). It will be constructed slightly to the north of the existing A47 from the A4 / A47 junction for approximately 800m, before crossing the existing A47 where it will be constructed to the south of the existing alignment until it ties into the existing dual-carriageway east of Nene Way.

1.2. Activity Background

1.2.1. This safety risk assessment has been developed to consider the option of not providing illumination for the following underpasses:

- The Walking, cycling and horse-riding route on the disused railway track (S02)
- Sacrewell Farm underpass (S05)

2. Safety risk assessment process

2.1. Safety risk assessment planning

2.1.1. This safety risk assessment has been carried out to consider the option of not providing lighting at the disused railway path underpass (S02) and the Sacrewell farm road underpass (S05).

2.2. Categorisation of activity

2.2.1. In accordance with GG104 Requirement for safety risk assessment, the overall activity categorisation of this activity is Type A as shown in Table 2-1.

Table 2-1: Justification of categorisation

Feature	Type	Justification
Extent of prior experience of activity.	A	There is significant experience and knowledge of providing illumination in underpasses.
Statutory and formal processes and procedures (including standards and legislation).	A	No departures or other processes required.
Impact on the organisation.	A	There will be very little impact on the organisation.
Activity scale.	A	There will be limited impact of this activity.
Technical.	A	There will be little technical innovation or novelty in the design and operation of the options.
Stakeholder impact and interest.	B	Stakeholders are affected.

2.3. Identification of affected populations

2.3.1. In accordance with GG104, consideration has been given to the populations identified in Table 2-2.

Table 2-2: Explanation of populations

Population	Classification
People directly employed by Highways England and who work on the motorway and all-purpose trunk roads either permanently e.g. traffic officers, or periodically e.g. those undertaking site visits; AND People in a contractual relationship with Highways England, including our national vehicle recovery contract operatives, all workers engaged in traffic management activities and incident support services, and any other activities where traffic is present, such as persons carrying out survey and inspection work.	Workers
All road users, including the police and emergency services, equestrians, cyclists and pedestrians, as well as those others, who are at work but are not in a contractual relationship with Highways England such as privately contracted vehicle recovery and vehicle repair providers.	Users
Other parties includes any person or persons who could be affected by the Highways England motorway and all-purpose trunk roads, but who are neither using it, nor working on it i.e. living or working adjacent to the motorway and all-purpose trunk roads, using other transport networks that intersect with the motorway and all-purpose trunk roads.	Other parties

2.3.2. The populations affected by this proposal are considered to be:

- Workers – Risk to maintainers
- Users – Risk to users of the underpass
- Other parties – Risk of criminality (linked to users and workers)

2.4. Safety risk assessment scope

2.4.1. This safety risk assessment only considers the option of not providing illumination of the underpass structures.

2.5. Safety baseline and safety objective

Safety baseline

Table 2-3: Safety baseline

Road Workers
There is no numerical objective or target for road worker accidents major schemes and the risk must be managed in accordance with the 'as low as reasonably practicable' (ALARP) principle.
Users
There is no numerical objective or target for path users, therefore as per workers the risk will be managed in accordance with the 'as low as reasonably practicable' (ALARP) principle.
Other parties
There is no numerical objective or target for path users, therefore as per workers the risk will be managed in accordance with the 'as low as reasonably practicable' (ALARP) principle.

Safety objectives

The ALARP principles apply for all populations.

2.6. Assumptions

2.6.1. The following assumptions have been made relating to this safety risk assessment.

- The unlit underpasses would feature dark spots during daytime and in particular during winter months.
- The level of path use is likely to be low during late evenings and early mornings.
- A full illumination option would require a mains power supply.

3. Safety risk assessment

3.1. Hazard identification

3.1.1. The hazards identified are detailed in Table 3-1, Table 3-2 and Table 3-3.

3.2. Hazard analysis

3.2.1. Analysis of the identified hazards are detailed in Table 3-4, Table 3-5 and Table 3-6.

3.3. Analysis of safety risk

3.3.1. The risk value attributed to each hazard has been formulated using the matrix from GG104 and shown in Figure 3-1.

Likelihood (L) x Severity (S) = Risk value (R)		Severity (S)				
		Minor harm; Minor damage or loss no injury	Moderate harm; Slight injury or illness, moderate damage or loss	Serious harm; Serious injury or ill-ness, substantial damage or loss	Major harm; Fatal injury, major damage or loss	Extreme harm; Multiple fatalities, extreme loss or damage
Likelihood (L)	Very unlikely; Highly improbable, not known to occur	1	2	3	4	5
	Unlikely; Less than 1 per 10 years	2	4	6	8	10
	May happen; Once every 5-10 years	3	6	9	12	15
	Likely; Once every 1-4 years	4	8	12	16	20
	Almost certain; Once a year or more	5	10	15	20	25

Risk Value (R)	Required action
Low (1-9)	Ensure assumed control measures are maintained and reviewed as necessary.
Medium (10-19)	Additional control measures needed to reduce risk rating to a level which is equivalent to a test of "reasonably required" for the population concerned.
High (20-25)	Activity not permitted. Hazard to be avoided or risk to be reduced to tolerable.

Figure 3-1: Risk matrix

Table 3-1: Worker hazard identification

Item	Who	What	Where	When	Why	How
1	Workers – maintaining power source.	Working with live power.	At lighting installation.	When carrying out maintenance.	Illumination requires a power source and cabling.	Risk of electrocution of workers.
2	Workers – maintaining lights.	Working at height.	At lighting installation.	When carrying out maintenance.	Light fittings will be mounted at height requiring ladder or MEWP access.	Risk of falls from height.
3	Workers – maintaining underpass and path.	Low levels of illumination.	Within structure.	When carrying out maintenance and inspections.	Low levels of lighting available within the structure.	Risk of slips, trips and falls.

Table 3-2: User hazard identification

Item	Who	What	Where	When	Why	How
1	Users – path users.	Low levels of illumination.	Within Structure.	24 hours.	Low levels of illumination within the structure.	Risk of slips, trips, falls and collisions with other users.

Table 3-3: Other parties hazard identification

Item	Who	What	Where	When	Why	How
1	Other parties – users of the underpass.	Risk to security.	Within Structure.	24 hours.	Low levels of illumination within the structure may conceal a person intent on criminal activity.	Risk of assault or robbery.
2	Other parties – users of the underpass.	Exposure to live power.	Within Structure.	24 hours.	In the event of vandalism to lighting installation, users are at risk to exposed cables and fittings.	Risk of electrocution.

Table 3-4: Worker hazard analysis

Item	Hazard	No illumination
1	Risk of electrocution to workers maintaining lighting.	Not applicable.
2	Risk of falling from height to workers maintaining lighting,	Not applicable.
3	Risk of worker slips, trips and falls within the structure.	With no illumination it is likely that during winter months the light levels within the underpass will be low, increasing the risk of workers slipping, tripping and falling.

Table 3-5: User hazard analysis

Item	Hazard	No illumination
1	Risk of path users slips, trips and falls within the structure.	With no illumination it is likely that during winter months the light levels within the underpass will be low, increasing the risk of users slipping, tripping and falling, or colliding with other path users.

Table 3-6: Other parties hazard analysis

Item	Hazard	No illumination
1	Risk of criminality involving assault or robbery.	The unilluminated underpasses may present a setting for an opportunist assault/robbery particularly during darkness hours.
2	Risk of electrocution as a result of vandalism.	Not applicable.

Table 3-7: Workers analysis of risk

Ref	Hazard Description	No illumination			
		L	S	R	
1	Risk of electrocution to workers maintaining lighting.	0	3	0	No electrical elements would be present.
2	Risk of falling from height to workers maintaining lighting,	0	3	0	No electrical elements would be present.
3	Risk of worker slips, trips and falls within the structure.	3	2	6	Dark areas within the structure increases this risk.

Table 3-8: Users analysis of risk

Ref	Hazard Description	No illumination			
		L	S	R	
1	Risk of path users slips, trips and falls within the structure.	4	2	8	Dark areas within the structure increases the risks of falls.

Table 3-9: Other parties analysis of risk

Ref	Hazard Description	No illumination			
		L	S	R	
1	Risk of criminality involving assault or robbery.	3	3	9	The area has a history of anti-social and criminal activity.
2	Risk of electrocution as a result of vandalism.	0	3	0	No electrical elements would be present.

3.4. Evaluation of safety risk

3.4.1. The evaluation of risk is based on a low, medium and high scoring which translates to the Health and Executives Tolerance of Risk model which ranks risk as “broadly acceptable”, “tolerable” and unacceptable”.

3.4.2. Risks identified as “broadly acceptable” are generally regarded as sufficiently low, insignificant and adequately controlled. These hazards would be continued to be reviewed and risk reduced wherever it is reasonably practicable to do so. In most cases this is where cost is insignificant or where the law requires it.

3.4.3. None of the risk identified have been classed as medium or high. Therefore, all hazards associated with the underpasses being unlit are classed as “broadly acceptable”.

3.4.4. This assessment deals purely with safety risk and does not consider environmental constraints.

4. Document and maintain the safety risk assessment

4.1. Update the safety risk assessment

4.1.1. The safety risk assessment should be reviewed in the event of a significant change or incidents occurring within the scheme limits which either invalidate the assumptions of the safety risk assessment or could change the outcome of the evaluation of safety risks.

4.2. Assumption validation and monitoring

4.2.1. Further monitoring should be carried out as part of routine performance measuring as per standard for a Type A activity.

Appendix B. The effect of reduced street lighting on road casualties and crime in England and Wales

OPEN ACCESS

The effect of reduced street lighting on road casualties and crime in England and Wales: controlled interrupted time series analysis

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► Additional material is published online only. To view please visit the journal online ([redacted])

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ABSTRACT

Background Many local authorities in England and Wales have reduced street lighting at night to save money and reduce carbon emissions. There is no evidence to date on whether these reductions impact on public health. We quantified the effect of 4 street lighting adaptation strategies (switch off, part-night lighting, dimming and white light) on casualties and crime in England and Wales.

Methods Observational study based on analysis of geographically coded police data on road traffic collisions and crime in 62 local authorities. Conditional Poisson models were used to analyse longitudinal changes in the counts of night-time collisions occurring on affected roads during 2000–2013, and crime within census Middle Super Output Areas during 2010–2013. Effect estimates were adjusted for regional temporal trends in casualties and crime.

Results There was no evidence that any street lighting adaptation strategy was associated with a change in collisions at night. There was significant statistical heterogeneity in the effects on crime estimated at police force level. Overall, there was no evidence for an association between the aggregate count of crime and switch off (RR 0.11; 95% CI 0.01 to 2.75) or part-night lighting (RR 0.96; 95% CI 0.86 to 1.06). There was weak evidence for a reduction in the aggregate count of crime and dimming (RR 0.84; 95% CI 0.70 to 1.02) and white light (RR 0.89; 95% CI 0.77 to 1.03).

Conclusions This study found little evidence of harmful effects of switch off, part-night lighting, dimming, or changes to white light/LEDs on road collisions or crime in England and Wales.

INTRODUCTION

Within a context of cost constraints and increasing local accountability for climate change mitigation, technological innovation is enabling changes to the provision of street lighting in England and Wales in ways that may have important implications for public health. Emerging technologies, such as LED lighting and computerised central management systems, have created opportunities for local authorities to adapt their street lighting strategies in ways that can reduce energy costs and contribute to reductions in carbon emissions. However, there is also concern that reductions in street light at night might increase road traffic injury, crime and fear of crime.

Local authorities are able to draw on national guidance on lighting[1] and professional standards[2] when making decisions about street lighting, but ultimately make their own assessment of the most appropriate lighting regime on each road for which they have responsibility. Three street light adaptation strategies reduce the amount of light: switching lights off permanently ('switch off'), reducing the number of hours that lamps are switched on at night ('part-night' lighting), and reducing the power or output of lamps ('dimming'). A fourth strategy is to replace traditional sodium lamps (orange/yellow light) with more energy efficient lamps or LEDs ('white light').

Each of these strategies has prompted public and media concerns about the negative effects that focus on risks of night-time road traffic collisions, crime, and fear of crime.[3] Road collisions have received particular attention, with a number of coroners concluding that reduced street lighting contributed to road deaths sparking inquests.[4] However, health and well-being benefits from reduced light pollution (eg, improved sleep and being able to see the night sky) have also been noted.[5 6] There are also putative benefits from reductions in artificial light at night, which have been linked to a range of health outcomes affected by disruptions to the circadian rhythms.[7–9]

Public concern that street lighting is necessary for road safety and crime prevention is, in part, supported by the literature: systematic reviews have identified some evidence for improved road safety[10] and an overall reduction in crime[11] with increased street lighting. However, with respect to crime, studies show that reductions in victimisation are observed during both hours of daylight and darkness,[11] calling into question the mechanism through which improvements to street lighting might influence crime. Moreover, there is to date, no empirical evidence on whether the implementation of reduced street lighting has had any negative effects on these important public health outcomes. National research on the effects of reduced street lighting on road traffic collisions and crime is, therefore, timely.

Theoretically, street light adaptation strategies might influence the risk of road traffic collisions and crime in a number of ways. Reducing lighting levels by switch off, part-night lighting, or dimming can reduce visibility in an area, which may increase the risk of collisions if road users are no longer able to detect hazards. Reduced visibility may also decrease mobility if fear of collisions, falling over in the dark, or fear of crime deters people from making some journeys. Fewer people on the streets might reduce road casualties by reducing the

potential for collisions, but may decrease the 'natural surveillance' in an area, leading to an increase in crime. Reduced visibility may also reduce crime, such as theft from vehicles or robbery, if criminals are less able to identify potential targets. The introduction of energy efficient lamps, or LEDs, can change the quality and colour of lighting (eg, from yellow to white light) without reducing visibility. White light might improve visual acuity, and by improving closed circuit television (CCTV) images can make criminals feel more conspicuous, thus deterring certain types of crime.

The broader cultural meanings of street lighting as one component of modern (sub)urban life may also link switch off, part-night lighting and dimming strategies to crime. Residents and visitors may feel that areas targeted for lighting reductions have been devalued; this may lower levels of community pride, leading to behavioural changes that influence crime. Alternatively, introducing new technologies, such as white light/LEDs, in an area may signal increased investment in a community to local residents, which may increase community pride and a willingness to use, and to monitor, their neighbourhood, leading to a reduction in crime.

In summary, street light adaptation strategies may have different effects on two public health outcomes, casualties and crime. In light of a lack of evidence, we used the reduction of street lighting by local authorities in England and Wales as a natural experiment to examine whether it was associated with any changes in road traffic collisions and crime. The project was called the LANTERNS (Local Authority collaborators' National Evaluation of Reduced Night-time Streetlight) project.

METHODS

We designed a controlled interrupted time series analysis to examine associations between reduced street lighting and road traffic collisions and crime, adjusting for regional trends. Analyses were conducted at road level for traffic collisions and at area level for crime. Analyses were based on the patterns of change in monthly counts of collisions and crimes within each street, or area.

Data sources

Street lighting—all local authorities in England and Wales were invited to participate in the study (details of recruitment methods are reported elsewhere).[3] From local authorities who had made changes to street lighting provision at night, data were requested on the geographic location of each street lighting column, the change to lighting (eg, part-night lighting), and the date the change was introduced. All local authorities who provided usable data by October 2014 were included in the analysis.

Traffic collisions—data on traffic collisions were obtained from STATS19, the official dataset of collisions on public highways in the UK collected by the police. Data were obtained on the dates, times, geographical coordinates of collision locations, and severity of casualties for all collisions that occurred during the period 2000–2013.

Crime—data on crime were obtained from the [redacted] website from December 2010 (the earliest date for which the data are available) to December 2013. Data included type of crime, year, month, name of road where the crime occurred, and approximate geographical coordinates.

Exposure variables

Street lighting—data were linked using a geographical information system (GIS) to a detailed road segment database derived from the Ordnance Survey Mastermap Integrated Transport Network.[12] For each month between January 2000 and December 2013, road segments were categorised according to whether switch off, part-night lighting, dimming and white light had been implemented in the lighting columns along that segment. Where combinations of interventions had been implemented (eg, part-night lighting with white light), road segments were categorised as having both interventions. To facilitate area-level analyses, we also calculated the proportion of total kilometres of road in each area that had introduced switch off, part-night lighting, dimming and white light.

Outcome variables

Traffic collisions—collisions recorded in STATS19 were classified as 'night-time' (occurring between sunset and sunrise) or 'day-time' (between sunrise and sunset) according to the time and date of the collision. For this, we obtained the daily timings of sunrise and sunset in each region of England and Wales between 1 January 2000 and 31 December 2013. Using data on injury severity, we classified each collision according to whether any casualties suffered a fatal or serious injury. A casualty is classified as fatal if the person dies within 30 days of the collision. A casualty is defined as serious if the person is admitted to hospital or has suffered fractures, concussion, internal injuries, crushing, non-friction burns, severe cuts and lacerations, or is in severe general shock requiring medical treatment. A GIS was used to link collisions to road segments using a combination of spatial overlay and analysis of the text descriptor of each road location. In brief, the algorithm assigned a collision to the nearest road segment of the type indicated in the STATS19 report. Collisions occurring over 50 m from a road segment of the appropriate type were excluded from analysis. We calculated counts of collisions in road segments for each month from January 2000 to December 2013.

Crime—to preserve victim anonymity, the publicly available [redacted] data only includes approximate geographical coordinates of offences, and does not detail the time of day of offences. A study of the spatial accuracy of the data suggests that it is very good for large areal units, such as census Middle Super Output Areas (MSOA), that contain around 7500 people,[13] but not for the postcode or street segment level. We therefore analysed crime at the MSOA level, assigning each offence to the relevant MSOA. We analysed offences most likely to occur during the evening or at night: burglary, theft of (or from) a vehicle, robbery, criminal damage, and violence, including sexual assault.[14] We calculated counts of each offence in MSOAs for each month from December 2010 to December 2013.

Statistical methods

Our focus was to characterise the influence of changes in street lighting on collisions and crime after allowing for underlying trends over time. Analyses were based on the patterns of change in the monthly counts of collisions within each road segment, and in the monthly counts of crime within each MSOA. To control for confounding due to differences in areas chosen and not chosen for interventions, we analysed these road level (collision) and MSOA level (crime) counts as 'panel' studies, conditional on total counts in each road or MSOA, such that any of the factors that are constant over time (eg, road design) contribute no information to the analysis. Conditional Poisson regression models were used rather than standard Poisson models to allow variation in rates by road segment and MSOA without having to directly estimate a large number of nuisance parameters.[15] Further details of the models are given in web

appendix 1. We conducted sensitivity analyses by assuming a negative binomial, rather than Poisson model, by allowing for zero inflation and by fitting models without autoregression terms.

Traffic collisions—We estimated the association of each street lighting adaptation intervention with night-time collisions from a single model to avoid mutual confounding. To guard against bias due to changes concurrent with lighting interventions that impact on overall (ie, day and night) collisions, the data set included counts of daytime collisions and a binary variable indicating day/night. We estimated from our regression model the change in collision rate associated with each street lighting adaptation intervention during daytime as well as night-time, and the ratio of night-time and daytime changes. We consider this 'daytime collision' adjusted measure the most robust estimate of the change in night-time collisions following the lighting intervention. Models were adjusted for seasonal variation and temporal trends by fitting individual terms for year and month. Models were fitted for each region in England and Wales, and effect estimates were pooled in a fixed effects meta-analysis.

Crime—we estimated the association between changes in the proportion of total kilometres of road in each MSOA that had introduced each street lighting adaptation intervention, and counts of each criminal offence (and their aggregation), controlling for trends in crime over time. We fitted indicator variables for the number of months elapsed from the start of the study (ie, a step function for elapsed month, from December 2010). We fitted separate models for each police force in view of their different data collection systems and evidence for different background time patterns across these systems. We pooled effect estimates in a random effects meta-analysis. Given the large number of police forces and types of crime considered, we do not present forest plots of the meta-analyses in the main text, only the means for England and Wales.

RESULTS

By October 2014, we had had direct contact with 125 (72%) of the 174 local authorities in England and Wales, resulting in data submissions from 71 local authorities of which 62 provided usable data (figure 1). Data for nine authorities were excluded due to missing information on dates of changes, and changes implemented after the end of the study. Local authorities from each region provided data. The participating local authorities were evenly distributed across deciles according to population density (persons per hectare), covered the range of deprivation levels as measured by the Index of Multiple Deprivation 2010, and covered each of the six urban–rural classifications of areas.

Street lighting—of the 62 local authorities with usable data, 5 (8%) had introduced switch off, 30 (48%) had introduced part-night lighting, 40 (65%) had introduced dimming, and 52 (84%) had introduced white light. The introduction of street lighting adaptation strategies increased steadily from 2009 (figure 2). By December 2013, the local authorities participating in this study had implemented white light on a total of 15 833 km of road (7% of total road km in the 62 participating local authorities); part-night lighting on 12 101 km of road (5%); dimming on 10 519 km of road (4%); and switch off on 946 km of road (0.4%). The proportions of total kilometres of road in each MSOA that had lights switched off ranged from 0% to 60% (median 0.03%; IQR 0.01–0.05%). For part-night lighting, the proportions ranged from 0 to 84% (median 0.2%; IQR 0.1–18%); for dimming, the proportions ranged from 0 to 93% (median 0.14%; IQR 0.07–5%); and for white light, the proportions ranged from 0 to 81% (median 1%; IQR 0.15–11%).

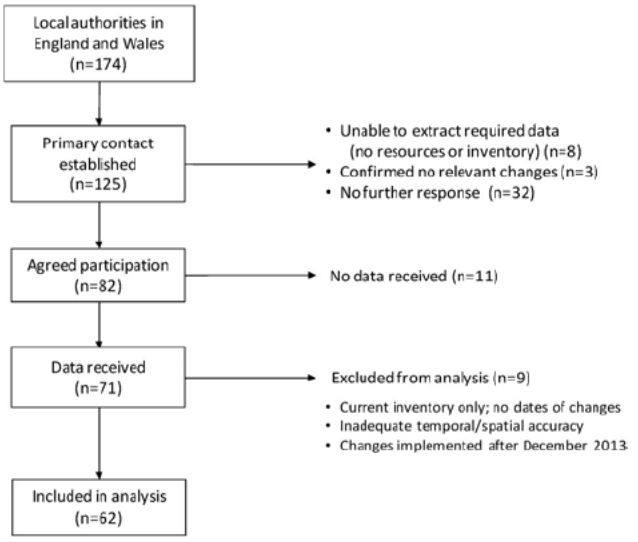

Figure 1 Flow of local authority participants in the LANTERNS project.

Traffic collisions—during 2000–2013 there were 859 935 collisions in the 62 local authorities included in the analysis; of these, 161 049 (19%) were night-time collisions; 153 442 (18%) collisions had resulted in a serious injury or fatality. Of the night-time collisions, 1202 (0.7%) occurred on roads along which switch off had been introduced by December 2013; 5670 (4%) were on roads with part-night lighting; 11 634 (7%) were on roads with dimming; and 12 423 (8%) were on roads with white light.

We found little evidence for any associations between street light adaptation strategies and day-adjusted night-time collision rates (figure 3). There was no evidence from any of the regional models, or the overall estimates, for an association between switch off (rate ratio (RR) 0.97; 95% CI 0.82 to 1.15), part-night lighting (RR 0.95; 95% CI 0.84 to 1.07); or dimming (RR 1.00; 95% CI 0.91 to 1.10). There was weak evidence in London for an association between the introduction of white light and increased night-time collisions (RR 1.30; 95% CI 1.03 to 1.65); however, the overall national estimate provides no evidence for such an association (RR 1.01; 95% CI 0.93 to 1.09).

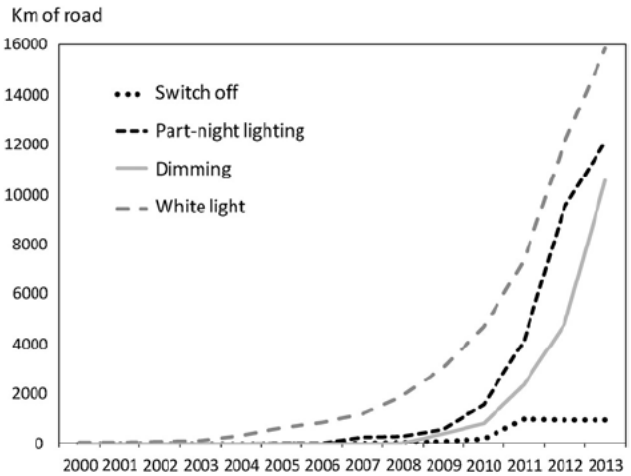

Figure 2 Kilometres of road with lighting adaptation strategies implemented in participating local authorities.

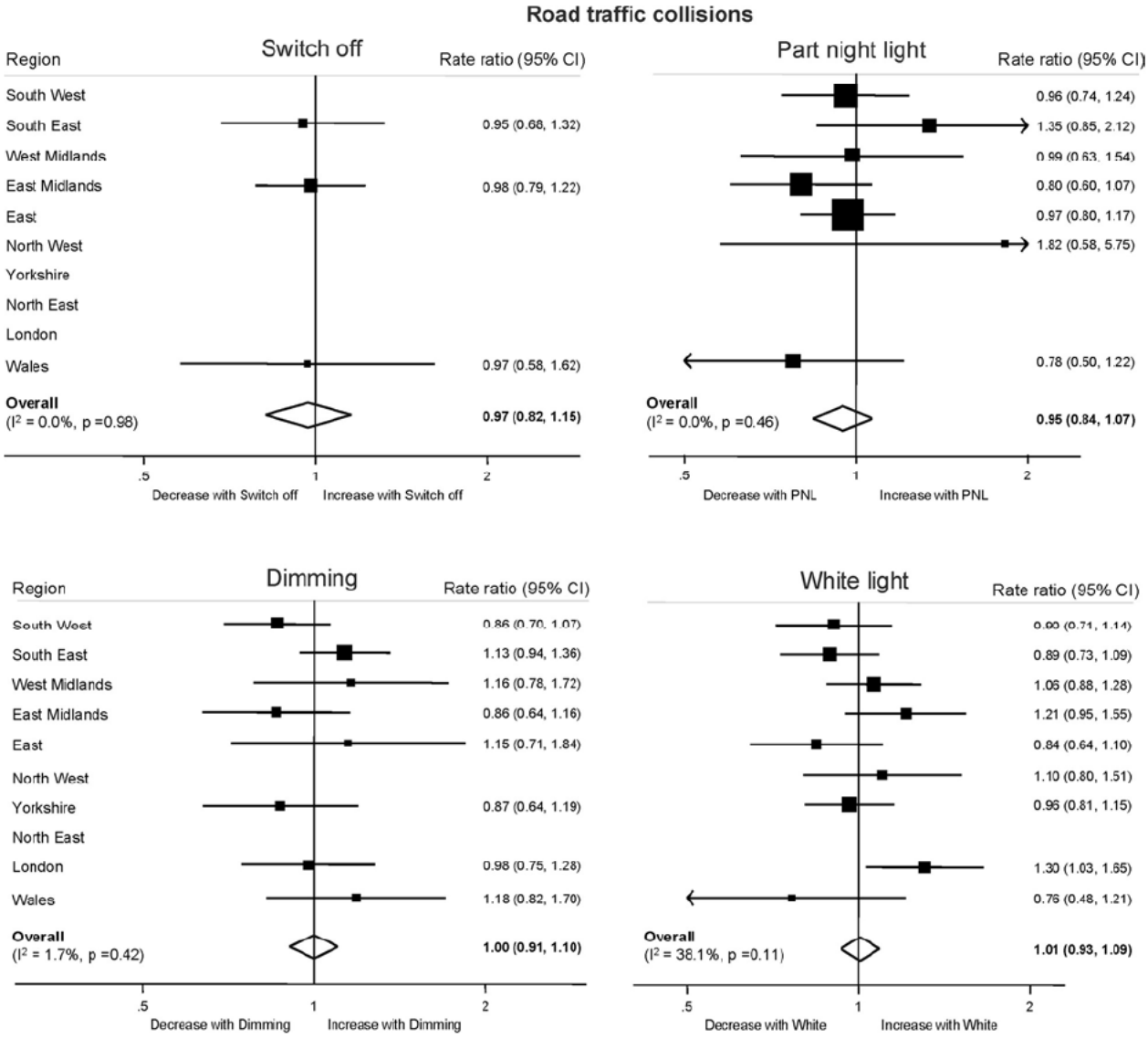

Figure 3 Associations between street light adaptation strategies and night-time road traffic collisions.

Similarly, models estimating associations between street light adaptation strategies and collisions causing a serious injury or fatality found no evidence for associations with any lighting intervention (see web appendix 2).

Crime—across the 62 local authority areas there had been 581 837 burglaries; 475 657 thefts of or from a vehicle; 67 470 robberies; 486 367 criminal damage offences and 730 280 violence offences during the period December 2010 to December 2013.

Figure 4 shows the estimated mean associations between changes in the proportion of total kilometres of road in each MSOA that had introduced each street lighting adaptation intervention, and counts of each offence across England and Wales. The rate ratios indicate the expected change in crime if 100% of total kilometres of road in an area were to receive the lighting intervention.

There was no evidence from the overall estimates for an association between the aggregate count of crime and switch off (RR 0.11; 95% CI 0.01 to 2.75) or part-night lighting (RR 0.96; 95% CI 0.86 to 1.06). There was weak evidence for a reduction in the aggregate count of crime and dimming (RR 0.84; 95% CI 0.70 to 1.02), and white light (RR 0.89; 95% CI 0.77 to 1.03). We found significant heterogeneity between the estimates at police force level (see web appendix 3); there was strong evidence for an association between part-night lighting, dimming and white light, and a decrease in crimes in some police forces, and strong evidence for an association between part-night lighting, dimming and white light, and an increase in crimes in others.

When specific offences were considered, the estimates provide suggestive evidence that part-night lighting may be associated with an increase in robbery (RR 1.48; 95% CI 0.99 to 2.21), and that dimming may be associated with a decrease in violence (RR 0.78; 95% CI 0.60 to 1.01). At the national level, we found consistency in the direction of the estimated associations between crime and dimming, with all point estimates indicating reductions in crime. There was similar consistency in the estimated associations with white light, all suggesting reductions in crime. Again, however, we found substantial statistical heterogeneity between estimates of associations between all lighting adaptations on all crime types at police force level (see web appendix 3).

Small differences were apparent in sensitivity analyses, but the results for collisions and crime were not materially different from the main results. We found no evidence for zero inflation.

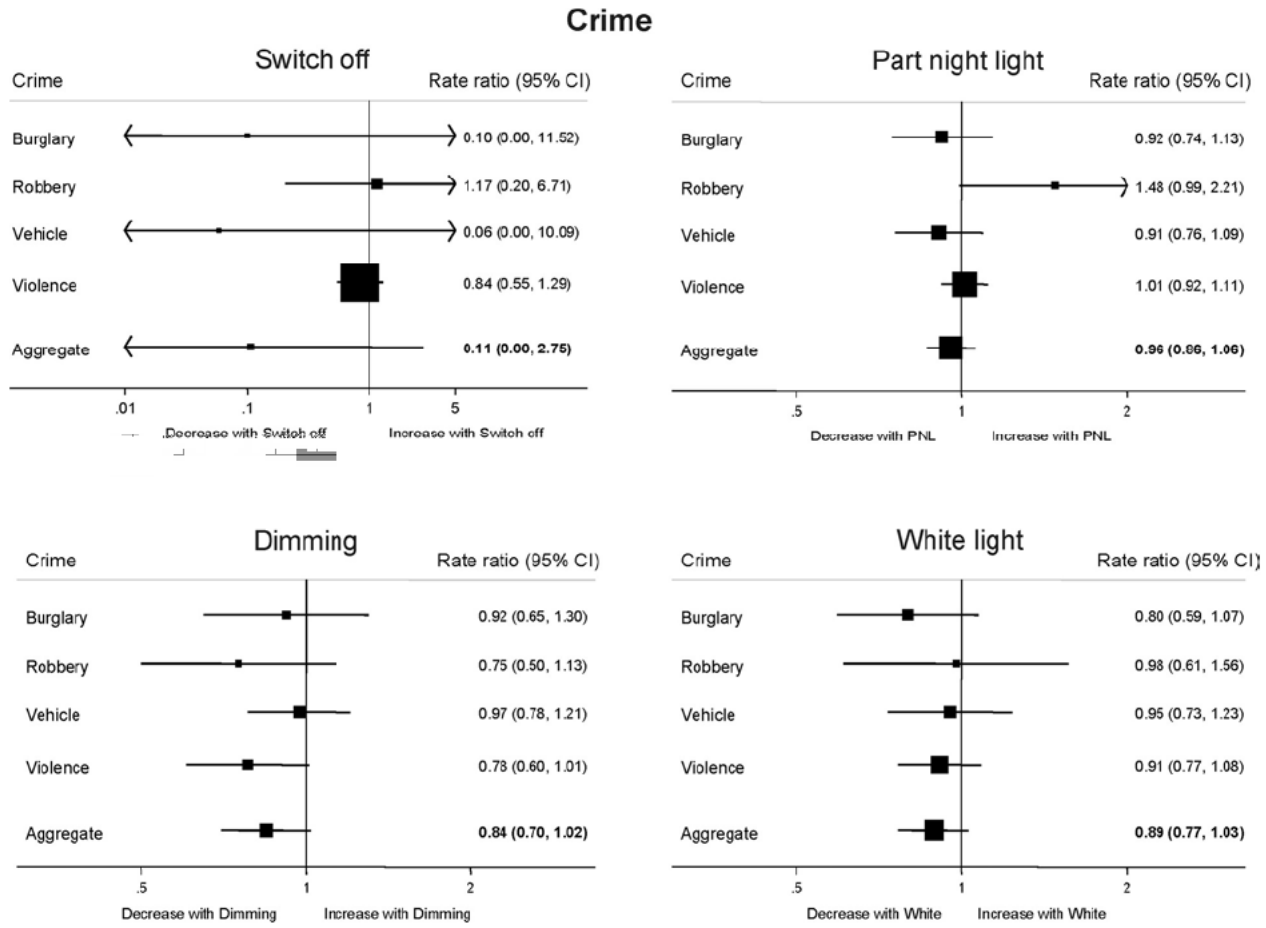

Figure 4 Associations between street light adaptation strategies and crime.

DISCUSSION

The results provide no evidence that switch off, part-night lighting, dimming, or white light adaptations to street lighting were associated with night-time traffic collisions. The results also provide no evidence that these lighting strategies are associated with an increase in crime at an area level. Results suggest that in the aggregate, dimming and white light regimes were associated with reductions in crime, though estimates were imprecise.

Limitations

Selection bias: this study was able to obtain usable data on street lighting changes from 62 of 174 local authorities. It is possible that local authorities may have declined to participate because of expected or known increases in collisions or crime in their areas due to lighting changes. If changes in collisions or crime are greater in the non-participating authorities, our study may have underestimated the effects of reduced lighting on collisions and crime.

Information bias: our study used routine data sources on road traffic collisions and crime. These data sets have several limitations; in particular, they may be incomplete due to under-reporting of incidents. However, for under-reporting to affect the results of our analysis this would require differential changes over time in the recording of crime and collisions in the streets where lighting has been changed, compared with streets without changes to street lighting, which seems unlikely.

To address the potential for under-reporting to bias estimates of effect on collisions, we analysed separately those collisions where casualties were fatally or seriously injured, as these collisions are more likely to be reported to the police. These analyses found no evidence for associations between street lighting changes and night-time collisions. We also analysed crimes that are more likely to be reported to the police (ie, burglary and vehicle theft reports are required for insurance claims). The estimated effects were not consistently larger for these two types of crime.

We were unable to specifically examine crime occurring at night using the [redacted] data. Our analyses were, however, limited to crimes that the crime survey of England and Wales suggests are more likely to occur in the evening or at night. It is unlikely that another data set would have been able to address this limitation, as the exact times of many offences (such as property or vehicle thefts) are unknown to victims. The [redacted] crime data have a further limitation: they are geographically obscured to protect the anonymity of victims. To address this, we analysed the data at an area level for which the spatial accuracy of the data is known to be good,[13] though this diminished statistical power.

Confounding: We did not take into account the potential impact of other road safety or crime prevention initiatives, such as improved road markings, policing interventions, or CCTV. If such measures have been introduced more often in streets where lighting has been changed than elsewhere, it is possible that some of the changes in crime in areas where lighting has been changed may be attributable to these other measures.

Despite the limitations of this study, we utilised two large publicly available data sets to provide evidence on the relationship between recent street lighting adaptation strategies, road traffic collisions and crime. Systematic reviews of the evidence on the effects of increased street lighting on road traffic collisions and

crime suggest relative reductions of 32% and 38%, respectively.[10 11] The current study showed CIs sufficiently narrow to exclude changes in collisions of such magnitude. The results for crime were highly heterogeneous and limited in power due to the need to aggregate to MSOA level, but the average effects estimated overall do not suggest any increase in crime at an area level with reduced lighting. Again, CIs were sufficiently narrow to exclude an increase in crime of such magnitude as may have been expected. The estimates for switch off, however, are imprecise because of the small number of areas in which switch off was implemented, and so should be treated with caution.

Interpretation

Despite using 14 years of data on road traffic collisions in 62 local authorities, we found no convincing evidence for associations between street lighting adaptations and road traffic collisions. As we have no direct measures of the number of trips taken, or modes of travel before and after implementation of street lighting interventions, we cannot know whether this reflects reduced mobility or changes in mode (eg, from walking to car travel) in areas where either switch off or part-night lighting had been implemented. It is possible that the numbers of pedestrians, cyclists, motorcyclists and car drivers who travel within the streets where street lighting was reduced declined at the same time as the lighting was reduced, resulting in fewer collisions in those streets. If so, any increase in hazards to road users due to lower lighting conditions may have been obscured by a reduction in numbers of people exposed to road injury risk at night. However, qualitative and survey evidence[3 16] suggests that changes to mobility overall, and mode choice in areas affected were likely to be minimal.

This study did, however, suggest an association between some street lighting adaptations and crime. While there was significant statistical heterogeneity in effects estimated at police force level, results overall were suggestive of an association between dimming and reductions in crime, particularly for violent crime. These results may lend support to the hypothesis linking lower levels of visibility to difficulties in identifying 'suitable' targets from those on the street at night. Results also suggested an association between white light and reductions in crime, particularly burglary, which may provide support for the credibility of mechanisms linking increased visibility or increased investment in local communities to reductions in crime. If reduced street lighting displaces pedestrian activity to better-lit streets, this might reduce the risks of victimisation and interpersonal crime on those streets, and increase guardianship on the better-lit streets. Different causal mechanisms may apply in different contexts, and these need to be assessed by further research.

This study does not support concerns around impacts of switch-off, part-night lighting, dimming and white light on crime and road safety. Local authorities informally (and sometimes formally) assess risks when adapting street lighting in local areas, drawing on local experiments and trials,[17] and national and professional guidance on the selection of lighting classes.[1 2] Considerations of the appropriate 'lighting class' for roads reflect a number of factors, including speed limits, traffic volume, composition of motorised versus non-motorised traffic, junction density, presence of parked vehicles, ambient luminosity (lighting from other sources such as shops), and how easy the road is to navigate.[1] Results from this study suggest that when risks are carefully considered, local authorities can safely reduce street lighting saving both costs and energy using switch off, part-night lighting, dimming, and white light strategies without necessarily impacting negatively upon road traffic collisions and crime. The participating local authorities included a good range of communities in terms of population density, geographic location, and economic resources. Our results may, therefore, be generalisable to other communities considering street lighting reduction strategies.

This study was able to shed light on the impact of reduced street lighting at night. More research is needed on how different lighting regimes affect opportunities for crime and crime prevention, and on other public health impacts of changes in light at night, given the suggestive evidence that artificial light may be linked to health outcomes as diverse as obesity,[7] sleep and cancer.[8]

What is already known on this subject

- There is evidence that introducing street lighting at night is associated with reductions in road traffic crashes and crime.
- Many local authorities in England and Wales are reducing street lighting at night to save energy costs and reduce carbon emissions.

What this study adds

- There is no evidence that reduced street lighting is associated with increases in road traffic collisions or crime.
- Dimming the amount of light or switching to white light/LEDs may reduce crime in an area.
- When risks are carefully considered, local authorities can safely reduce street lighting, saving energy costs and reducing carbon emissions, without impacting negatively on traffic collisions and crime.

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Contributors All authors contributed to the design of the study and the writing of the manuscript. RS, CP and LT collected, managed and linked the GIS and outcome data. CG provided advice on data management. RS, BA and PE conducted the statistical analysis. SJ advised on analysis of crime data.

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Competing interests None declared.

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Appendix C. Extract from ‘Preventing Crime: What Works, What Doesn't, What's Promising’

727's and DC 9's to prevent them from being opened in flight (Landes 1978). In early 1973, the U.S. and Cuba signed a treaty that required each country to extradite or punish hijackers (Landes 1978).

Landes (1978) attempted to determine the effectiveness of sky marshals and passenger screening. He used a time series analysis of 64 quarter years and 143 incidents. He also controlled for hijacking of aircraft originating from foreign airports to remove world-wide trends in skyjacking and attempted to remove the effects of the Cuba treaty. He provides evidence for an 82 percent decline in U.S. hijacking due to the combined effects of the Cuba treaty, sky marshals, and passenger screening. He then estimated the contribution of the three policies: screening was the cause of a decline of 45 percent, sky marshals created a 28 percent decline, and the remainder (9 percent) was probably attributed to the Cuba treaty.

Two other studies, using annual data for different time periods and weaker evaluation designs, also found large declines in aircraft hijacking in the United States following passenger baggage screening (Wilkinson 1977; Easteal and Wilson 1991). These studies did not attempt to estimate the effects of different hijacking programs.

The variation in aircraft hijacking from year to year and the virtually simultaneous implementation of multiple prevention methods at airports around the world make it difficult to come to definitive conclusions regarding any particular intervention. Nevertheless, the weight of the evidence supports the effectiveness of passenger screening.

These findings are important. First, they demonstrate the potential utility of opportunity blocking against highly determined offenders. Second, they illustrate some of the difficulties of evaluating place-focused prevention (multiple simultaneous interventions, detecting reductions in rare events, and the difficulty of finding control places). And third, they may have implications for other places.

What do these findings about the use of metal detectors to screen for weapons at airports tell us about their deployment at other places? These devices have been used to enhance the security of court buildings, schools, government offices, and public housing. Are they effective? From an empirical perspective, we can only say we do not know. Evaluations are scant and weak. A New York City study of the use of metal detectors found that weapon carrying in schools with metal detectors (n=19) was lower than in schools without the devices (n=96), but there were no differences in assaults within or outside these schools (Centers for Disease Control and Prevention 1993). This evaluation has a scientific methods score of four, and although there was a decline in risk-factors for violence, there was no significant decline in violence. In the residential places section we noted an evaluation of a multi-tactic intervention in a particularly troubled set of public housing buildings (Popkin, et. al. 1996). Metal detectors were a part of this program, but it is impossible to determine what, if any, influence they had because so many other things were implemented at the same time. We cannot, therefore, be confident about the transferability of this tactic to other, very different settings.

Table 7-8: AIRPORTS

STUDY	SCIENTIFIC METHODS SCORE	TACTIC	SETTING	RESULTS
Easteal & Wilson. 1991	2	passenger screening with metal detectors	US Airports and originating flights	64% reduction in hijacking of passenger aircraft
Landes 1978	3	passenger screening with metal detectors	US Airports and originating flights	45% reduction in hijacking of passenger aircraft
	3	sky marshals		28% reduction in hijacking of passenger aircraft
Wilkinson 1977	3	passenger screening with metal detectors	airports	41% reduction in hijacking of passenger aircraft in US, 3% drop world-wide

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OPEN PUBLIC SPACES

The places considered in this section are open spaces in cities, including street corners and segments. Four types of interventions will be examined. The first is the control of problem offenders. The second is improved lighting. The fourth is the use of closed-circuit television (CCTV). Finally, we examine street closures and rerouting.

Controlling Problem Offenders

Two efforts to control public drinking as a means to reduce assaults and incivilities in downtown areas provide evidence that controlling problem offenders may be effective. Ramsay (1990; 1991) reports on the banning of public drinking in one English town. Comparing the year before and the year after the ban (with no control group) he found no changes in assaults, but surveys of people using the area suggest that there may have been a reduction in incivilities. A Swedish effort to reduce disorder at an annual festival reported a decline in drunkenness and disorderly conduct arrests following the prohibition of public drinking, banning high risk offenders, and the closing of a popular camping site (Bjor, Knutsson and Kuhlhorn 1992). This study compared arrests at the previous year's festival to arrests at the festival with the restrictions, without control area comparisons.

Lighting

Lighting campaigns seek to enhance the ability of people to provide protection for each other. In 1979, the predecessor agency of NIJ, the National Institute of Law Enforcement and Criminal Justice, reported on a review of 60 lighting evaluations. The authors of this review concluded:

"*Is street lighting an effective approach in the reduction and deterrence of crime?* The answer is inconclusive. The paucity of reliable and uniform data and the inadequacy of available evaluation studies preclude a definitive statement regarding the relationship between street lighting and crime." (Tien, et. al. 1979, page 93, emphasis in the original)

Almost twenty years later, we know little more about the effectiveness of lighting.

In the 1980's, a borough in London upgraded all of its street lighting. Atkins, Husain and Storey (1991) compared reported crimes the year before the relighting to the year following for 39 sections of the borough. No control areas were used, so background trends in crime cannot be assessed. No systematic changes in crime were detected. Surveys of residents of one area found no changes in perceptions of security.

A Scottish study of relighting in a Glasgow neighborhood and a small town near Glasgow found that there was a short term reduction in victimizations that varied from 32 percent to 68 percent, depending on how victimization was measured (respondent victimizations, victimization of respondents' children, victimization of other family members, victimization of friends, or car victimization). Reported crime dropped 14 percent. The evaluators compared a three-month period prior to relighting to a three-month period following (Ditton and Nair 1994). No control group was used and the results for the two neighborhoods were combined.

Finally, we need to consider three separate evaluations, with similar designs, undertaken by Painter (1994). She examined lighting improvements on two separate street segments and a footpath, all located in "crime prone" areas within London. Pedestrians were interviewed before and after the lighting improvement. All interviews were conducted after dark and were completed within 6 weeks of the relighting. No interviews were conducted in control areas. Substantial reductions in robberies, auto crimes, and threats were reported in two sites (86 percent, 79 percent). These crimes were eliminated in the third site, but the number of crimes before relighting was small so this could have been the result of other factors.

Not much has changed since Tien and his colleagues (1979) gave their critical assessment of the impact of lighting on crime. In part this is due to the lack of research on lighting, particularly in the United States. However, the limited research on lighting continues to use weak designs (typically without control areas) which fail to substantially reduce our uncertainty about the effect of lighting on crime. We may speculate that lighting is effective in some places, ineffective in others, and counter productive in still other circumstances. The problematic relationship between lighting and crime increases when one considers that offenders need lighting to detect potential targets and low-risk situations (Fleming and Burrows 1986). Consider lighting at outside ATM machines, for example. An ATM user might feel safer when the ATM and its immediate surrounding area are well lit. However, this same lighting makes the patron more visible to passing offenders. Who the lighting serves is unclear.

Closed-Circuit Television

Closed-circuit television (CCTV) enhances the ability of a designated guardian to watch people in an area and to call for police intervention if potential trouble is detected. This is supposed to increase the risks of offending, but only if the CCTV surveillance is well known to the people who use the area. This project was unable to locate any published scientific evaluations of the use of CCTV in urban areas of the United States.

Three CCTV evaluations have been reported in Great Britain (Brown 1995). As deployed, a set of video cameras are posted in center city areas and monitored at a central station. The cameras cover many, but not all locations in the target area. Finding locations with clear unobstructed views, year round, can be difficult. CCTV cameras were installed around the town center of Newcastle-upon-Tyne in late 1992 and early 1993. Using a time series of 23 months prior to the installation of cameras, four months during, and 14 months after, and comparing CCTV covered areas to uncovered areas in the same period, Brown (1995) found that burglaries declined by 18 percent, auto thefts dropped 9 percent, thefts from autos went down 11 percent, and other thefts declined 7 percent. No effect was found for robberies.

Brown (1995) used a similar design to assess the impact of CCTV in Birmingham. He compared reported crime 12 months before, two months during, and 30 months after installation to control areas. Unfortunately, no figures were provided with the reported charts, but visual inspection of the time-series charts provided suggests reductions in robbery, burglary, and thefts. Similar results were reported for another town center in Great Britain, King's Lynn. Four quarters of reported crime before

installation were compared to seven quarters after. A control area was used. Again, the data was not given, but visual inspection of the charts suggests reductions in burglary, assaults, thefts from vehicles, and thefts of vehicles. Significance tests were not reported in any of these case studies.

The effectiveness of CCTV in open spaces is unknown due to the lack of significance tests. Given recent interest in the use of CCTV in the United States, this tactic should be given a high priority for rigorous evaluations. Absent evaluation results from installations in the United States, the level of uncertainty about CCTV effectiveness is too high to advocate its use except to test its effectiveness.

Street Closures

Research has suggested that areas with easy access have more crime than areas with street layouts that restrict access (White 1990; Beavon, Brantingham and Brantingham 1994). Oscar Newman (1982) reported on crime and its association with privately owned streets with limited access. He compared these streets in a St. Louis neighborhood to nearby publicly owned, free access streets and found that the private streets had less crime. In this section we will examine five evaluations that support the hypothesis that closing and rerouting automobile traffic can reduce crime.

In 1986 the citizens of Miami Shores, Florida (just outside Miami, in Dade County) voted to increase taxes to fund closing off 67 streets (Atlas and LeBlanc 1994). The closings took place between July 1988 and March 1991. The evaluation compared changes in reported crime within the town to the changes in the same crimes in the surrounding county and Miami. Mean 1986 and 1987 crimes (before installation) were compared to the mean number of reported crimes in 1991 and 1992 (Atlas and LeBlanc 1994). There were no significant changes in reported robberies and aggravated assaults within Miami Shores compared to the two control jurisdictions. Relative to changes in Dade County, reported burglaries significantly declined at least 8 percent. Larcenies and auto theft in Miami Shores also declined significantly, relative to changes in Miami and Dade County.

Newman (1996) reports the results of a street closure program in a Dayton, Ohio neighborhood. The Five Oaks neighborhood is a half-mile square area containing 2,000 homes on a grid street layout. Streets were closed off so that the area was subdivided into small areas and so one could not drive directly through the area. Newman (1996) summarized the City of Dayton evaluation results. Police-reported crime statistics showed that crime in the city rose one percent, but that total crime in the target neighborhood declined 26 percent, and violent crime declined 50 percent. Significance tests were not reported. Citizen surveys reported that over half of the residents felt crime had declined. Newman also reports that housing values increased after having declined prior to the street closures.

Two efforts to curb prostitution activity in London neighborhoods used road closures and rerouting coupled with increased police enforcement. In the Finsbury Park area police had steadily increased enforcement for two years prior to changes in the street closures. However, with the changes in the streets, "Soliciting and curb-crawling virtually disappeared and the area was transformed from a noisy and hazardous 'red-light' district into a relatively tranquil residential area." (Matthews 1992, page 94). Reported crime declined 50 percent for the 12-month period after the street closures compared to the previous 12 months. Observations of the area suggest that most of the prostitutes left the area but did not displace to adjacent neighborhoods (Matthews 1992).

In the Streatham neighborhood of London, street closures were also used in conjunction with increased police enforcement. Matthews (1993) reports a decline in traffic flow along key streets. Although police enforcement was maintained, arrests of "curb-crawlers" seeking sexual services declined by two-thirds (comparing the first quarter of 1990, after the program, to the first quarter of 1988, before the program began). Interviews of residents suggests a decline in noticeable prostitution activity, although some of this activity may have shifted to the periphery of that area.

The final evaluation of street closures was a retrospective analysis of the Los Angeles Police Department's Operation Cul-De-Sac. In 1990 the Los Angeles Police Department installed traffic barriers on 14 streets in a South Central Los Angeles neighborhood with a high level of drug activity, shootings and homicides. Much of the violence was created by disputes over drug sales locations by local gang members. The barriers were designed to make the driveup purchase of drugs more difficult and prevent drive-by shootings. This effort was part of a larger law enforcement effort to suppress these crimes. Two years following the installation of the barriers, the barriers were abandoned and then removed as the police became embroiled in the controversy surrounding the Rodney King beating.

The evaluation of the Los Angeles Police Department project compared reported crimes in the neighborhood for four quarters before the barriers were installed, the eight quarters while they were being maintained, and 16 quarters after the program was abandoned (Lasley 1996). Reported crime for the four adjacent areas was also examined. If one uses the surrounding beats as control areas, the net effect of the installation of the barriers (before, compared to during) was that homicides decreased 65 percent. In fact, during the two years when the barriers were installed there was only a single killing in the target area. Once the barriers were no longer maintained and were removed (comparing the installed period, to the after period) homicides rose 800 percent, relative to the surrounding area killings. Total violent crimes (homicide, rape, street robbery, aggravated assault and purse snatching) declined from the pre-program period to the two years during the program (8 percent for the first year and 37 percent for the second year) and then rose again after the program fell into disuse. At the same time the surrounding areas remained relatively stable. Lasley attributes most of the decline in violent crime to changes in aggravated assaults. Significance tests were not reported for any of these comparisons.

Closing streets makes offenders' escapes more problematic. In the case of prostitution cruising and drive-by shootings, the offenders are likely to follow a circular driving pattern in their search for targets. By making circular driving patterns more difficult and increasing the chances offenders will find themselves at the end of a dead end street, criminal behavior may be thwarted.

The street closure evaluations used moderately strong designs and their conclusions are consistent with theory and prior research. This gives us confidence that this approach to curbing crime should be classified as "promising." In at least three of the programs (the two London prostitution cases and the Los Angeles drive-by shooting case), the street closures were undertaken along with police crackdowns. Matthews (1992) hypothesizes that street closures and enforcement may be more effective when used together than when used separately and enforcement should be used prior to street changes. This opportunity-blocking tactic for controlling crime in open urban areas deserves more attention by, particularly since it might reduce violence under some circumstances.

Conclusions for Open Urban Places

Four types of tactics were considered in this section. There is limited evidence that controlling offenders, particularly public drinking, might be useful. However, the evaluations are small in number and weak in design, leaving its effectiveness unknown.

Lighting has received considerable attention. Yet, evaluation designs are weak and the results are mixed. We can have very little confidence that improved lighting prevents crime, particularly since we do not know if offenders use lighting to their advantage. In the absence of better theories about when and where lighting can be effective, and rigorous evaluations of plausible lighting interventions, we cannot make any scientific assertions regarding the effectiveness of lighting. In short, the effectiveness of lighting is unknown.

The installation of CCTV in urban areas might be a fruitful area for research, but its effectiveness is unknown. Though several evaluations had scientific methods scores of 3, the absence of significance tests limits what we can claim for the effectiveness of this tactic. We cannot recommend the adoption of this tactic, except for purposes of testing.

Finally, compared to the other tactics examined, street closure evaluations have been conducted with greater rigor. We also have evaluation evidence that is consistent with theory and research. This tactic appears to be promising and deserves greater attention, particularly in high crime areas.

Table 7-9: OPEN PUBLIC PLACES

STUDY	SCIENTIFIC METHODS SCORE	TACTIC	SETTING	RESULTS
Bjor, Knutsson, & Kuhlhorn 1992	2	ban on public drinking & high risk offenders & closing of a parking site	Open spaces of downtown area, Sweden	8% reduction in drunkenness arrests 64% reduction in disorderly conduct arrests
Ramsay 1991 Ramsay 1990	2	ban on public drinking	Open spaces of a British downtown area	No change on assaults 33% reduction in insults from strangers
Atkins, Husain, and Storey. 1991	2	lighting	39 sections of London	no systematic effect of lighting
Ditton & Nair 1994	2	lighting	Glasgow neighborhood	32% to 68% reduction in victimizations. 14% reduction in reported crime
Painter 1994	2	lighting	London	86% reduction in street robberies, auto crimes, and threats
	2	lighting	London	78% reduction in street robberies, auto crimes, and threats